U. S. ARMY TEST AND EVALUATION COMMAND
EXPANDED SERVICE TEST - SYSTEM TEST OPERATIONS PROCEDURES

AMSTE-RP-702-102
*Test Operations Procedure 3-3-116
AD 755642

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SIGHT, DIRECT FIRE

SECTION I
GENERAL

1. Purpose and Scope.

a. This document provides procedures for testing direct fire weapon sights. It establishes test methods and techniques for conducting an expanded service test to determine whether a test item meets the criteria described in applicable materiel requirements documents and is suitable for use by the US Army.

b. These procedures apply to weapon sights designed for aiming direct fire weapons. They are applicable for testing imaging or non-imaging night sights, low light level sights, or daylight sights. These procedures can be used for testing sights that are an integral part of a weapon as well as sights that are employed as an accessory to a weapon for special purpose use.

*This TOP supersedes MTP 3-3-082, 27 May 1971.

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c. This document provides for tests conducted in a realistic tactical environment, to include simulated combat conditions when appropriate. It does not include environmental testing for extreme climatic conditions. Observations of the climatic conditions prevailing during the expanded service test will be made to provide a record for future evaluations.

d. These procedures address a preoperational inspection to determine the physical characteristics and serviceability of a test item, a series of appropriate tests designed to examine a test item's operational and functional performance characteristics, and an examination of the human factors and value engineering aspects of a test item.

2. Background.

a. Direct fire sights are devices that aid a soldier in aligning his weapon with a target, using the target itself as the aiming point.

b. The most common form of sighting equipment on a weapon consists of two separate points which can be aligned with a target. This equipment normally consists of a front sight placed on the muzzle or foremost part of the weapon and a rear sight placed on the rear of the weapon near the eye of the firer. Sights of this type are commonly referred to as iron sights. For all weapons except those used only for short ranges, the rear sight is usually adjustable both in elevation and deflection to compensate for the curved flight of the projectile between the weapon and the target. The front sight is normally of simple construction, being a rod or post that can be seen sharply outlined against a target. The rear sight is provided with a hole or notch through which the front sight and the target are viewed.

c. Some optical sights with magnification give the firer an enlarged view of his target. These magnified optical sights are usually straight line telescopes which consist of an objective lens, erecting system, and eye lens contained in a dust proof tube, supplemented by some form of reticle or scale within the telescope. This reticle, scale, or aiming post is seen by the gunner exactly as if it were on his target. By moving the reticle or by selecting one of the various lines etched on the reticle, the firer can make the necessary angular adjustments to compensate for range and deflection. These telescopic sights are particularly useful for firing at long ranges and are usually limited to weapons designed for special purposes only, such as sniper rifles.

d. Another type of optical sight is the reflecting (or reflex) sight. This consists of a semitransparent concave mirror set opposite a glass disk upon which a miniature reticle has been placed. The mirror and disk are housed in a short tube sealed to prevent entrance of moisture that might fog the mirror surface. When the eye is placed close to the disk, the silvered reticle cannot be seen directly, but its reflection, greatly enlarged, appears distinctly on the concave surface of the mirror and appears to be projected on the target. A masking plate with a central aperture is inserted close to the glass disk with the reticle which aids in centering the eye on the axis of the sight. As the light passing through this sight is reflected by the mirror surface, not all of the light comes through and objects seen through the sight appear somewhat less bright than they would through a clear glass or telescopic sight.

e. During periods of darkness or reduced visibility the ability of the soldier to aim his weapon properly with the sights described above is reduced. First, the soldier may not be able to see clearly enough to visually align the front and rear elements of the sighting system with his target, and, second, the target itself may become indistinct or invisinle due to the low light level. Several sighting devices have been developed in an effort to overcome this difficulty. Those devices are referred to as night sights, or low light level sights, indicating they are intended for use when visibility is restricted to some degree; they are also categorized as being imaging or non-imaging sights.

f. An imaging sight is an optical device that assists the soldier in seeing a target. This type of sight utilizes devices that intensify the available visible light or converts some other form of radiation, emitted or reflected from the target, to visible light. Imaging night sights that have been developed include infrared devices which use a supplementary light source to illuminate the target, and "starlight scope" devices that use light amplification/image intensification to increase the ambient light to make the target visible. These devices assist the soldier in seeing and engaging targets, and usually include a reticle of some type for aiming the weapon.

g. A non-imaging sight is one that provides little or no assistance to the soldier in seeing the target but will permit the alignment of the weapon with his target during periods of reduced visibility. The non-imaging sight is useful only when the target can be seen with the unaided eye. Although various field expedient sighting devices and materials -- such as luminous tape or paint, usually on the front but sometimes on both front and rear sight elements -- have been used to provide luminous sights so a weapon may be aided during reduced

visibility, they have generally been unsatisfactory. The Army has recently adopted the Promethium 147 luminous front sight for use with the M16A1 rifle.

h. The development of direct fire weapon sights continues and future testing can be anticipated. The procedures described in this document can be used in planning and conducting such tests.

3. Equipment and Facilities.

a. Firing/observation ranges and targets.

b. Range instrumentation and recording equipment.

c. Weapons with test and control sights.

d. Ammunition.

e. Safety and first aid equipment.

f. Photographic equipment.

g. Photometric equipment.

h. Communications equipment.

i. Transport vehicles, ground and air.

j. Radiation measuring instruments (if applicable).

k. Power supply test equipment (if applicable).

l. Power supply charging equipment (if applicable).

m. Binoculars.

n. Stopwatches.

o. Cleaning materials and lubricants.

SECTION II
TEST PROCEDURES

4. Supporting Tests.

a. The procedures outlined in this TOP provide general guidance for the conduct of expanded service tests. Detailed specific procedures

are dependent on the characteristics of the item being tested and the stated criteria in applicable requirements documents.

b. In preparing for the test, the test officer should follow the necessary administrative, personnel, and supply preliminaries outlined in his test officer's guide or manual, or in the organization's standing operating procedures (SOP). He must keep in mind that sufficient pretest training must be accomplished to ensure test soldiers are equally familiar with the test and control item, if there is one. The performance of the test item should not be degraded because it is new, or the test troops are unfamiliar with the item.

c. During each subtest, sufficient data should be collected to support valid conclusions. This goal may be constrained by limitations on the number of test items, the time available for testing, manpower and funds available, and support and control equipment available. When planning the test, the test officer should consult with methodology personnel (e.g., statistical analysts, experimental psychologists, human factors analysts) to select the best technique for collecting meaningful and sufficient data to permit a valid evaluation of the test item. Methodology personnel can advise and assist the test officer in determining the appropriate experimental design to include the techniques for random sampling, the sample size required to evaluate the true performance, how to estimate average performance (or variability of performance) from a sample, how to compare materials or products with respect to average performance (or variability of performance), the number of test soldiers needed, and the number of repetitions required for a specific exercise. Additional statistical guidance may be found in TOP 3-1-002, Confidence Intervals and Sample Size, and in National Bureau of Standards Handbook 91, Experimental Statistics.

d. Common Service TOP's, the test defined in Section III, and other published documents to be considered in formulating an expanded service test plan are listed below. Additional reference material is listed in the Appendix.

	TEST SUBJECT TITLE	PUBLICATION NO.
(1)	Preoperational Inspection and Physical Characteristics	*6-3-501 3-3-500, *6-3-500
(2)	Safety	3-3-517, *6-3-523
(3)	Personnel Training and Selection (refer to para 5)	3-3-501, *6-3-502

	TEST SUBJECT TITLE	PUBLICATION NO.
(4)	Known Distance Firing (Daylight) (refer to para 6)	
(5)	Tactical Observation (refer to para 7)	
(6)	Tactical Field Firing (refer to para 8)	
(7)	Ambient Light Conditions (refer to para 9)	
(8)	Boresight and Zero	3-3-503
(9)	Man Portability/Transportability	*6-3-510, 10-3-506
(10)	Airdrop Operations	7-3-511
(11)	Compatibility with Related Equipment	4-3-519, *6-3-512
(12)	Qualitative Electromagnetic Interference	*6-3-513
(13)	Electrical Power Requirements	*6-3-517
(14)	Adverse Conditions	3-3-524, *6-3-509
(15)	Security From Detection	1-3-515
(16)	Maintenance Evaluation	*6-3-524, 10-3-504, and TECR 750-15
(17)	Durability and Reliability	*6-3-506, 10-3-502
(18)	Human Factors Engineering	3-3-521, *6-3-525
(19)	Value Analysis	TECR 700-1

*Volume 6 Common TOP's are applicable to sights with electronic devices.

SECTION III
SUPPLEMENTARY INSTRUCTIONS

5. Personnel Training and Selection

a. The applicable procedures described in MTP 3-3-501, Personnel Training, should be accomplished. When the test or control item

includes electronic devices, the procedures of MTP 6-3-502, Personnel Training Requirements, should also be accomplished.

b. The test soldiers must be sufficiently trained and oriented in the use of test and control sights and related weapons to provide for a safe, objective, and thorough test situation. The groups of test soldiers that will use the test and control sights should be matched as closely as possible with respect to tneir marksmanship qualifications, experience, and visual acuity. Soldiers with a night blindness condition should not be used.

c. The initial selection of test soldiers in regard to marksmanship qualification may be based on unit personnel records. These records, for various reasons, may not be a true indication of the soldier's current proficiency. Therefore, to verify marksmanship qualifications, the test soldiers should fire an appropriate qualification course with the weapon and sights that will be used as control items during the test. The test sights should also be used, if their use is applicable for qualification firing. The qualification scores should be recorded and used as a basis for selecting equally qualified groups of soldiers to use the test and control item during testing.

6. Known Distance Firing.

a. Objectives.

To determine the accuracy and dispersion of weapons equipped with the test and control sights when employed by soldiers representative of those expected to use the test item in combat.

b. Method.

(1) Misunderstanding sometimes occurs with the terminology associated with the ability of a weapon system to hit a target because of varying concepts of the terms "accuracy" and "dispersion." The definitions below explain accuracy and dispersion as used in weapon systems evaluation and in this test operations procedure.

(a) Accuracy: This describes the distance at which the center of impact of a shot group is located from the point of aim (this is sometimes called the "offset" distance). The ultimate in weapon accuracy is achieved when the mean point of impact (center of impact) coincides with the point of aim. However, it should be noted that perfect accuracy does not imply all rounds must impact on the point of aim; some degree of dispersion in the impact pattern is always to be expected.

(b) Dispersion: This describes the distribution of a series of rounds fired from a weapon under conditions as nearly identical as possible, the points of impact being dispersed about a point called the center of impact. Small dispersion is achieved when all projectiles impact closely about the center of impact, that is, when the distance of every impact from the center of impact is small, regardless of the relationship between the point of aim and the center of impact.

(2) Accuracy and dispersion can be attributed to many factors such as those inherent to the weapon/ammunition combination, tolerances in the weapon mount and in the fire control (or sighting) system, and those relating to the soldier/weapon/sight combination. All of these factors except the last one usually have been determined to a great extent under ideal test conditions during the design and engineering phases of testing. The expanded service test is normally the first time that a weapon/sight system will be tested under tactical field conditions by soldiers with the skills and aptitudes of those expected to use it in combat.

(3) This subtest is designed to measure the accuracy and dispersion of weapons equipped with the test and control sights when fired by test soldiers under optimum tactical consitions. That is, the test soldiers will be equipped with field uniforms and equipment, but the firing will be done on know-distance ranges against distinct, prominently identified targets.

(4) This subtest should be accomplished during daylight. Although some test sights may be intended primarily for use during darkness or reduced visibility, this daylight testing is designed to determine if degradation in accuracy occurs in daylight, or if a trade-off between accuracy and other characteristics is necessary.

(5) The weapons equipped with the test and control sights should be zeroed (or boresighted, as applicable), in accordance with the procedures prescribed for that weapon/sight combination. The zero firing should be at distances corresponding to the capabilities of the weapons and sights. For example, a rifle sight designed for daylight use might be zeroed at the battlesight zero range prescribed for the weapon. On the other hand, a rifle sight designed for night use might be zeroed at a much shorter range, based on the expected visibility range of the sight during darkness. In any event, the zeroing should be accomplished at the same distances as the known distance accuracy firings described below.

(6) After completion of zeroing, the weapons equipped with the test and control sights should be fired against vertical targets

at appropriate known distances to determine accuracy and dispersion. The target size should be large enough to ensure that the impact location can be determined for all rounds fired. An aiming point should be established near the center of the target. When dispersion at a prescribed range is greater than a practical size target, the range should be reduced and the reasons therefor explained in the test plan and/or report as applicable.

(7) Weapons should be zeroed with the applicable sight at each target range just prior to firing the accuracy groupings at that range. The initial zeroing should be verified at the end of the accuracy firings, or more often if sizable shifts in center of impact locations become apparent during firing.

(8) All modes of firing (semiautomatic, automatic, controlled bursts) appropriate for the weapon should be used. Trials with varying burst sizes may be conducted if deemed appropriate. If the weapon is other than a hand-held type (e.g., a machine gun or vehicular mounted weapon), all mounting systems furnished for the testing should be used during the accuracy firings. The firing position considered to be most stable for the weapon (e.g., the prone, sandbag-supported position for a rifle) should be used.

(9) A sufficient number of shot groups should be fired to obtain statistically valid data for each type of sight, mode of fire, and target range.

c. Data Required.

(1) A description of any difficulties in making adjustment of sights, or any other difficulties encountered during the zero firings.

(2) The number of rounds required to zero each weapon/sight combination.

(3) A description of any occurrence in which a weapon/sight combination failed to retain zero setting during the accuracy firings.

(4) Record the following data for each group of rounds fired in the accuracy and dispersion firings:

(a) Date and time of firings.

(b) Firers name.

(c) Target range (distance).

(d) Weapon/sight identification.

(e) Ammunition nomenclature and lot number.

(f) Firing mode (semiautomatic, automatic, controlled bursts).

(g) Firing position (prone, standing, kneeling).

(h) Type of mounting system (if applicable).

(i) The location (x and y coordinates) of impact on the target for each round fired. These locations should be expressed in terms of a horizontal and vertical distance from some fixed reference point. This reference point is somewhat arbitrary and may be the center of the target, a corner of the target, the aiming point, or any fixed point on the target. Once the reference point is selected and located, the horizontal and vertical distances of each impact will be measured to the center of each hole. If a point other than the aiming point is used as a reference for these measurements, then the coordinates of the aiming point should also be measured relative to the established reference point, to facilitate comparing the location of center of impact of a group of rounds with the location of the aiming point.

d. Analytical Plan.

(1) The test data resulting from the zero firings should be subjectively analyzed to determine any differences between the test and control sights in regard to zeroing characteristics.

(2) The coordinate data of impact locations obtained from the accuracy firings will be used to determine the horizontal, vertical and extreme spreads, the horizontal and vertical standard deviations, the mean radius, and the deviation of the center of impact from the point of aim.

(3) Appropriate statistical analyses of variance will be performed to determine if there are significant differences in the measure of accuracy and dispersion between the test and control items, or between the test item and established criteria. Comparison results should indicate whether the test item is worse than, equal to, or better than the control item or the established criteria.

7. Tactical Observation.

a. Objective.

To determine the capabilities and limitations of soldiers using the test item as a weapon sight to detect and identify targets under various ambient light conditions.

b. Method.

(1) This subtest applies to test sights designed to aid the soldier in seeing targets not clearly visible to the unaided eye. This includes optical or imaging sights with devices that intensify the available ambient light (starlight scope), that convert emitted or reflected radiation from the target to visible light (infrared weapon-sight), that magnify the firer's view of the target (sniper scope), or that use other means to enable the firer to see the target.

(2) Some test items may be designed to have a dual capability of employment as a weapon-mounted sight or as a handheld viewer (such as the starlight scope). This subtest applies only to the test item's use as a weapon-mounted sight; its use as a handheld viewer should be tested in accordance with the procedures in TOP 6-3-097, Night Observation Devices.

(3) Live firing will not be conducted during this subtest. The testing will consist of tactical observation exercises with test soldiers using the test and control sights, mounted on appropriate weapon, to observe an area and attempt to locate potential targets. Exercises will be conducted during both daylight and darkness.

(4) The test soldiers will be presented with simulated tactical situations requiring them to participate in defensive operations. The observed area, representing an assigned sector of the defensive position, will contain both stationary and moving personnel and materiel targets with varying conditions of camouflage. Target arrays will include individual and multiple targets in tactical disposition. Actual troops may be used for targets, or silhouette targets of types E, F, and M may be used.

(5) The field conditions should add realism to the test environment through the effects of terrain, vegetation, temperature, simulated enemy weapons and tactics, fields of fire, and engagement ranges. Terrain and vegetation should be of the widest variety possible and camouflage should be both natural and artificial. Illuminating shells, flares, exploding charges, and other battlefield light-producing phenomena should be introduced as appropriate during testing to

evaluate "white-out" or other detrimental effects of light on the sights. The test soldiers' observations and comments on difficulty of using the sights will be noted. Particular note will be made of any target obscuration effects of the sight reticle, restriction on field of view, or other features of the test and control sights.

(6) Each observation position should be a tactically valid and representative of a position from which a soldier might logically aim and fire his weapon in actual combat. Observation distances should vary (10 meters and greater), extending beyond the normal range of the test and control sights. The width of the area to be observed should compare to sectors normally assigned under tactical conditions for the type sight being tested.

(7) The target area should be interspersed with marker panels distinctly labeled with an identifying letter or number. Test soldiers may use these markers as reference points in describing the locations of targets observed through the test sights. For example, an observed target might be described as "two men standing at the left side of marker B," or "Five men walking in single file between markers 12 and 16."

(8) Appendix F (Target Detection Exercises) of FM 23-71, Rifle Marksmanship, may be used as a guide in setting up the range, planning the target schedules, and conducting the exercises. Tactical realism should be maintained to the maximum extent practicable. The targets should be exposed in a logical sequence to simulate enemy troops advancing. Targets should be equipped with signature devices to simulate enemy fire. If actual troops are used for targets, they may fire blank ammunition for this purpose. The exposure time and movement of targets will be controlled.

(9) Measures of effectiveness will be the percentage of targets detected and the quality of detection. Quality is based on an accurate identification or description of the target. To be scored as correct, a one-man target has to be reported as one man, while multiple target reports must not vary more than one person from the actual size. For example, a three-man target must be reported as two, three, or four men; a five-man target must be reported as four, five, or six men.

c. Data Required.

(1) A description of the range and target installation.

(2) Identification of weapon/sight combination.

(3) Observer's name.

(4) Weather conditions.

(5) Light conditions. If other than complete daylight, the amount of ambient light should be expressed in foot-candles.

(6) Number of targets presented, by range (distance).

(7) Target exposure time.

(8) Number of targets detected.

(9) Number of targets correctly described.

(10) A description of any difficulties encountered in use of the sights.

(11) A description of any detrimental effects of light on the sights.

d. Analytical Plan.

(1) The percentages of targets detected and targets correctly described will be computed as follows:

(a) $\frac{\text{Number of targets detected}}{\text{Number of targets presented}}$ = Percentage of detection

(b) $\frac{\text{Number of targets correctly described}}{\text{Number of targets detected}}$ = Percentage of correct descriptions.

(2) The data for targets detected and correctly described will be determined for each applicable range and light condition.

(3) Any difficulties reported in the use of the sights will be subjectively analyzed in comparing the test and control items.

(4) Appropriate statistical analyses of variance may be performed to determine if there are significant differences in target detection capabilities between the test and control items, or between the test item and established criteria. Comparison results should indicate whether the test item is worse than, equal to, or better than the control item or the established criteria.

8. Tactical Field Firing.

a. Objective.

To determine the hit probability and responsiveness of weapons equipped with the test and control sights when employed against targets in tactical disposition.

b. Method.

(1) This subtest is designed to provide a realistic evaluation of the weapon/sight/soldier combination in a tactical environment. Tactical field exercises should be conducted to provide influencing factors similar to those felt in combat, such as fatigue, noise, dust, smoke, stress, dirt, rain, and morale. The field conditions should also add realism to the test environment through the effects of terrain, vegetation, temperature, simulated enemy weapons and tactics, fields of fire, and engagement ranges.

(2) The test soldier will be presented with simulated tactical situations that require the test items to be employed in both the defense and the attack, and during both daylight and darkness. The test soldiers, firing weapons equipped with the test and control sights, will engage targets that depict enemy formations the soldiers would be likely to engage on a battlefield. Field target firing courses may be used to provide this experience. These firing courses should be located on irregular terrain so that the soldiers will have the opportunity to fire into various types of ground. Silhouette targets of types E, F, and M will be arranged to represent the enemy in linear, deep, and linear with depth formations. Target installations will include short exposure time (pop-up) targets, concealed targets, stationary targets, and moving targets.

(3) Target ranges should vary from close-in (approximately 25 meters) to distances beyond the capabilities of the weapon and/or sights. All modes of firing (semiautomatic, automatic, controlled bursts) appropriate for the weapon should be used. The firing position used (prone, standing, kneeling, foxhole supported) should be the most common ones from which a firer can detect and engage targets, commensurate with the simulated tactical situations. Firing exercises should include the use of both ball and tracer ammunition, as appropriate for the weapon.

(4) For defense type exercises, the firing course should have short exposure time (pop-up) targets arranged in various tactical formations out to the maximum effective range; concealed targets

emplaced at selected ranges out to the maximum range; stationary targets at the longer ranges; and realistically placed moving targets at selected ranges. The movable and pop-up targets should be controlled and manipulated so targets are exposed in a logical sequence to simulate enemy troops advancing, and should be equipped with signature devices to simulate enemy fire when the targets are exposed. The firing exercises should require the test soldiers to make shifts in both range and deflection from one target to one or more successive targets. The firing time and the ammunition expenditure permitted for each target array will be controlled.

(5) For attack type exercises, the firing course should contain personnel type pop-up target arrays and stationary targets. As the test soldiers advance through the attack course the pop-up targets should be exposed in a logical sequence and engaged as soon as they are seen by the test soldiers. The stationary targets should be engaged at will as they are detected by the soldiers. The exercises should include a simulated counterattack during consolidation, from pop-up target positions beyond the assault objective. The test soldiers should engage those targets from designated foxholes or other type firing positions appropriate for the weapon being fired.

c. Data Required.

For each exercise, record the following:

(1) A description of the range and target installation.

(2) Identification of weapon/sight combination.

(3) Firer's name.

(4) Type and lot number of ammunition.

(5) Weather conditions.

(6) Light conditions. If other than complete daylight, the amount of ambient light should be expressed in foot-candles.

(7) Number of targets presented, by range (distance).

(8) Target exposure time.

(9) Number of trigger pulls.

(10) Number of rounds fired.

(11) Number of targets engaged (detected and fired upon).

(12) Number of target hits.

(13) Number of targets hit.

(14) Time to first round, for each target array: measured from the time the target is exposed until the first round is fired at that target.

(15) Time to first hit, for each target array: measured from the time the target is exposed until the first hit is achieved on that target.

(16) Time between rounds in the semiautomatic mode, or time between bursts in the automatic mode, or time between bursts in the automatic or controlled burst mode. This measurement provides information about the effects of recoil and what happens to the man/weapon/sight picture when a round is fired. (After firing, the soldier must reacquire the target, realign the sights and targets, then refire).

(17) Time to shift fires, when two or more targets located some distance apart in range and deflection, are exposed concurrently: measured from the time a hit is acheived on one target until the first round is fired at a successive target. This measurement includes the time required to acquire the new target, make necessary position change, align the sights, and fire.

(18) Mode of firing (semiautomatic, automatic, controlled bursts).

(19) Firing position (prone, standing, kneeling).

(20) Distribution of near misses, if feasible.

(21) Record of any target obscuration caused by sights.

d. Analytical Plan.

(1) Hit probability, a measure of accuracy, may be expressed in terms of the following:

(a) Target hits (per round fired, per trigger pull, per target exposed, per target engaged, or per exposure time).

(b) Targets hit (per round fired, per trigger pull, per target exposed, per target engaged, or per exposure time). Sometimes, when several targets have been presented, two or more hits may be achieved on a single target, yet some targets will not be hit at all. It might happen that the competing weapon/sight systems have an equal number of total target hits, but one system has a greater number of total targets hit. In such cases, the measure of targets hit will provide an additional discriminator between the competing systems.

(c) Hit probabilities may be further categorized for each target range, mode of fire, firing position, and visibility condition.

(2) The data on distribution of near misses are used to analyze the pattern of fire. This information is an indication of the relative effectiveness of suppressive fires.

(3) Responsiveness may be measured in terms of the times determined in c(14) through c(17), above. The achieved times may be categorized for each target range, mode of fire, firing position, and visibility condition.

(4) Appropriate statistical analyses of variance may be performed to determine if there are significant differences in hit probability and responsiveness between the test and control items, or between the test item and established criteria. Comparison results should indicate whether the test item is worse than, equal to, or better than the control item or the established criteria.

9. Ambient Light Conditions.

a. Some of the weapon sights applicable for testing in accordance with this TOP may sometimes be referred to as "night sights" or "low light level sights," indicating they are intended for use when visibility is restricted to some degree. Test criteria or performance characteristics in requirements documents may state capabilities of the sights in terms of light conditions such as twilight, moonlight, starlight, or overcast. Parameters for these light conditions are not universally defined and may lead to confusion in testing. Therefore, to ensure uniformity and consistency in test results, the following definitions of ambient light conditions apply to tests conducted under provisions of this TOP:

Adjectival Light Condition	Ambient Light Band, in Footcandles
Dawn or Dusk	1 to 10
Twilight	1×10^{-1} to 10
Full Moon	1×10^{-2} to 4×10^{-2}
Half Moon	1×10^{-3} to 4×10^{-3}
Starlight	1×10^{-4} to 4×10^{-4}
Overcast	1×10^{-5} to 4×10^{-5}

b. Whenever possible, both the test and control item will be tested at the same time in order to achieve optimum equality of light conditions. However, when the test and control items must be tested successively, or when repetitions of a test are required, the succeeding tests should be done within the same light band (from the definitions above) as the initial test.

c. When performance measurements are requirement under a specified adjectival light condition, all tests for the performance characteristic will be done within the applicable light band. For example, if performance measurements are required under starlight conditions, the tests will be conducted when ambient light is between 1×10^{-4} footcandles and 4×10^{-4} footcandles.

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APPENDIX
REFERENCES

1. AR 70-10, Test and Evaluation During development and acquisition of materiel.
2. FM 23-8, Rifle, 7.62mm, M14 and M14A1.
3. FM 23-9, Rifle, 5.56mm, M16A1.
4. FM 23-11, 90mm Recoilless Rifle, M67.
5. FM 23-12, Technique of Fire of the Rifle Squad and Tactical Application.
6. FM 23-16, Automatic Rifle Marksmanship.
7. FM 23-31, 40mm Grenade Launchers, M203 and M79.
8. FM 23-33, 66mm HEAT Rocket, M72A1, M72A2, and M72.
9. FM 23-35, Pistols and Revolvers.
10. FM 23-67, Machinegun, 7.62mm, M60.
11. FM 23-71, Rifle Marksmanship.
12. FM 31-36, (Test), Night Operations.
13. National Bureau of Standards Handbook 91, Experimental Statistics.
14. TECR 70-23, Equipment Performance Reports.
15. TECR 70-24, Documenting Test Plans and Reports.
16. TECR 310-6, TECOM Test Operations Procedures.
17. TECR 385-6, Verification of Safety of Materiel During Testing.
18. TECR 750-15, Maintenance Evaluation During Testing.
19. TECOM Pam 310-3, Test Operations Procedures Style Manual.
20. TOP 1-1-012, Classification of Deficiencies and Shortcomings.
21. TOP 1-1-019, Testing Armament and Individual Weapons.

22. TOP 1-1-041, Airportability and Airdrop Service Testing.

23. TOP 1-1-046, Field Combat Testing Exercise.

24. TOP 6-3-097, Night Observation Devices.